H. S. John.

Rhodora

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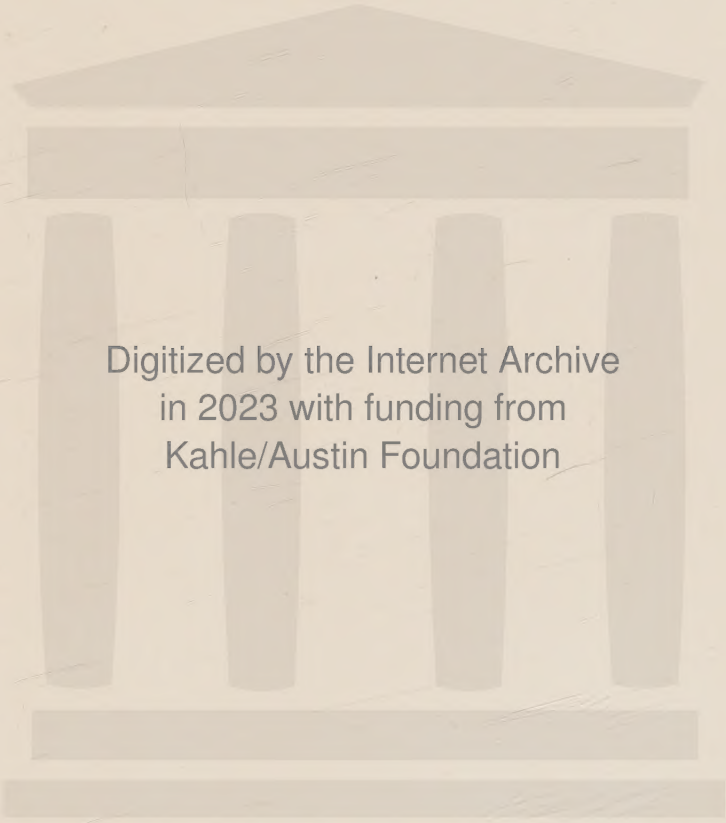

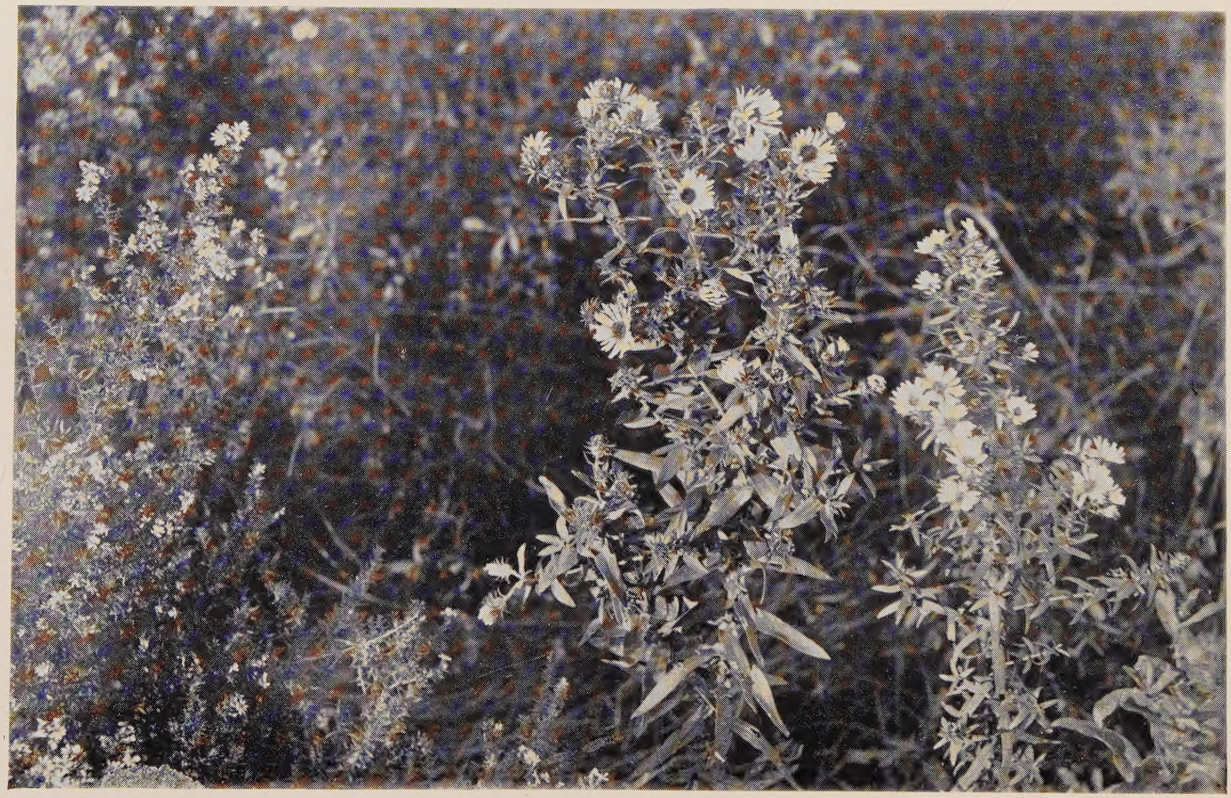

ASTER AMETHYSTINUS (right), A. MULTIFLORUS (left), and A. NOVAE-ANGLIAE (center)

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THE NEW ENGLAND BOTANICAL CLUB

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ASTER AMETHYSTINUS AN OBVIOUS HYBRID

H. C. Benke

(Plate 192)

Although no positive proof through experiment has come to my notice, yet, in view of personal experience with the very pretty and rare *Aster amethystinus* Nutt., I feel quite safe in declaring it to be a hybrid. Hybridism has long been suspected, so it is well to add my own observations here. The genus *Aster* is a favorite of mine and I have had opportunity for nearly thirty years to study it in the field, especially in the Central States, where the species under discussion grows. In that long period of time and among vast numbers of asters seen, only on three occasions was *Aster amethystinus* found.

1. While waiting for a train at the station at Kaukauna, Wisconsin, fifteen years ago, a field of asters was noted along a ditch or canal some 100 feet to the north. Walking closer to the plants, I came upon a large, bushy, vigorous-growing plant of the species under consideration. There were numerous plants of *A. novae-angliae* L. about, for this species is common in the region. Of. *A. multiflorus* Ait.[1] there were but a few plants, for it was rare in that locality, but they were quite close by—not more than five feet away. Sample branchlets of the plant were obtained for the herbarium. There was but a single plant in evidence. It is my number 767, Kaukauna, Wisconsin, 1914, and is now in the Public Museum of Milwaukee.

[1] This aster, so well known as *A. multiflorus* Ait., appears to be the original Linnaean species *Aster ericoides* L. Sp. Pl. 875. 1753. See Mackenzie, Rhodora 28, p. 65. 1926.

2. Many thousands of wild asters were seen through the succeeding years in Wisconsin, Illinois, Missouri, Kansas, and other states, all in its range, but not until October 2, 1926, did I come upon another specimen, which was found growing in the edge of a Chicago suburb on a bit of original prairie. This is my number 4316 in the herbarium of Field Museum. With the sheet is placed another giving samples of species in closest proximity and bearing a notation, in part, as follows:

"*Aster amethystinus* Nutt., no. 4316, was found growing in a vacant lot about one-half mile south-east of the railroad station at Edison Park, a suburb north-west of Chicago.

"On this sheet are aster species found growing in proximity—the only species within a hundred feet or so.

"A. *Aster multiflorus* Ait., plants within five feet north and also south of No. 4316; and B. *Aster novae-angliae* L., a few plants a bit farther north and north-east of same. The only other species in proximity was C. *Aster ericoides* L., var. *villosus* T. & G.

"The characteristics of No. 4316 are so evidently an average between A and B in every way that one may regard *Aster amethystinus* as a hybrid with constant qualities between the two, No. C being out of the reckoning."

3. It was two years later, on September 29, 1928, that I came upon my third specimen in an extensive field of original prairie,[1] several miles to the north-east of the locality previously mentioned, about Norwood Park, another suburb of Chicago. Specimens of branchlets were again obtained—my No. 4868 in the herbarium of Field Museum.

A photograph, submitted herewith (plate 9), was taken in the field showing one of the tufted branches of *Aster amethystinus* at the right in the picture, other branches—not shown—being widely spreading or reclined, while a plant of *A. novae-angliae* is growing quite close by with *A. multiflorus* somewhat farther removed, as indicated in the left of the picture.

To summarize the evidence: In each case there was but a single plant (or tuft, branching from the base), the herbarium specimens on file being but branchlets or off-shoots and not complete plants.[2] The plants were all out of the range of *A. oblongifolius* Nutt., which

[1] It is to be regretted that this fine field of virgin prairie plants is being destroyed by a large colony of workmen, camping there with their horses.

[2] It was my good fortune to be able to revisit the site of the second plant discussed each fall since 1926, and I found the plant persisting, but it is still the single plant it was when first seen, no other plants having appeared to this time.

does not occur in the regions cited, a species with which it might be confounded except for its strict habit as seen in the field and its occurrence as solitary and rare plants—a second specimen was not to be found in the neighborhood in any case cited. It might be overlooked, however, because of other similarities in regions where *A. oblongifolius* is common—the Illinois and Wisconsin banks of the Mississippi River, for example. The presence in close proximity of the two species before mentioned in each case observed and the strikingly intermediate characteristics of the plant between the two furnish added circumstantial evidence that this charming aster may, with good reason, be regarded as a hybrid.

CHICAGO, ILLINOIS.

EXPLANATION OF PLATE 192

ASTER AMETHYSTINUS (right) with A. MULTIFLORUS (left) and A. NOVAE-ANGLIAE (center).

A NEW FORM OF ASTER AMETHYSTINUS.—On October 5, 1924, while in the western part of Worcester, Massachusetts, on a quest of *Aster amethystinus*, I found a group of plants, with altogether some thirty stalks, all bearing pink-rayed flowers, a specimen living plant of which has been placed in the Botanic Garden at Cambridge. This plant, elsewhere unknown, is here proposed as

ASTER AMETHYSTINUS Nutt., f. **leucerythros**, n. f., ligulis roseis.—MASSACHUSETTS: along remnants of old wall once a boundary of Liberty Farm of Abby Kelly Foster fame, Worcester, October 5, 1924, *E. W. Bemis* (TYPE in Gray Herbarium).—EARL W. BEMIS, Worcester, Massachusetts.

SOME ADDITIONS TO THE NEWFOUNDLAND FLORA.—The summer of 1929 from mid-June to mid-September I botanized in southwestern Newfoundland while my husband fished the salmon streams. Mr. Richard P. Whittington from his headquarters at Spruce Brook furnished us cabins on Barachois Brook, Harry's Brook and Highlands Pond successively.

Professor Fernald had said "Bring back anything rare or interesting"—a puzzling commission to an amateur guided only by the manuals published several years ago. And I frequently put specimens to press with a feeling that, absorbingly interesting as they were to

me, they were probably very old stories to the Gray Herbarium. Four, however, turn out to have significance.

On the right bank of Barachois Brook near the mouth *Hydrocotyle americana* L. was abundant. Rare? Hardly likely. Yet now Professor Fernald tells me that my specimens are the first from Newfoundland. Beside the cabin at Force le Plain pool on Harry's Brook grew handsome clumps of an *Anemone* taken to be *A. virginiana* L. Professor Fernald says it is *A. riparia* Fernald, not before found in Newfoundland. New also is *Impatiens pallida* Nutt. which grew luxuriantly on Crabbes Brook at the entrance to the path which leads from Whitecliff Pool (1 mile above the railroad bridge) to Crabbes station. And new an unfamiliar *Potamogeton* pulled up with a handful of *P. bupleuroides* near the bridge pool on Highlands Brook. This proved to be *P. subnitens* Hagström, a hybrid between *P. bupleuroides* Fernald and *P. gramineus* L.

Four plants not previously reported from the island make, I submit, as satisfying a season's catch as did the salmon and trout long since devoured. Of *Lotus corniculatus* L. and *Crepis biennis* L., also found there for the first time, the less said the better except to hope, for the sake of Newfoundland farmers, that I pulled up the sole specimens of each and that they will never be found there again.—R. B. KENNEDY [MRS. SINCLAIR KENNEDY], Patterson, Putnam County, New York.

A NEW LOCO FROM THE EDWARDS PLATEAU OF TEXAS

V. L. CORY, *Grazing Research Botanist*

INTRODUCTION

From about the middle of March to the middle of May of this year (1929) a survey of the loco plants of western Texas and southern New Mexico was made by the Bureau of Animal Industry of the U. S. Department of Agriculture. Through the courtesy of Dr. C. D. Marsh, under whose direction the work was done, and his associates of the Department of Agriculture an opportunity was afforded the Texas Agricultural Experiment Station to coöperate in this important work, and this opportunity was gratefully accepted. Thus it was the writer's good fortune to have a small share in this undertaking, and

he wishes, both on behalf of the Texas Station and of himself, to express deep appreciation of the consideration and courtesy shown to us in this matter.

Each of the five field workers engaged in this survey was allotted a definite territory to cover, and the area worked by the writer consisted of that portion of the Edwards Plateau lying east of the Pecos River. This paper is a contribution to the knowledge of the distribution of loco in that area as gained through the prosecution of this work. In the identification of species the writer has been greatly assisted by Dr. Ivan M. Johnston of the Gray Herbarium.

Description

Astragalus argillophilus Cory, sp. nov. Perennial, decumbent, in vigorous specimens as much as a meter across, much branched from a woody root and with the tips of fruiting branches ascending or erect, densely silky-villous throughout and tomentose; stipules 10 mm. long, whitish, membranaceous, prominently green-veined, long-acuminate, adnate to the petiole; leaves 10–20 cm. long with long petioles and about 11 or 12 pairs of leaflets, villous throughout with weak, spreading hairs; leaflets 19–29, 4–15 mm. wide and 7–30 mm. long, elliptic to ovate, acute, entire, villous-tomentose on both surfaces; flowers in dense axillary racemes, which are 4–12 cm. long; peduncles 10–20 cm. long, with pedicels 1 mm. long subtended by very villous subulate bracts 5 or 6 mm. long, or as long as the calyx-tube; calyx cylindric, 9–12 mm. long, the subulate teeth nearly equaling the tube, villous; corolla ochroleucous, rarely yellow or purplish, about 15 mm. long, the wings and banner considerably surpassing the obtuse keel; pod 15–20 mm. long and 6–7 mm. broad, shortly stipitate, coriaceous, completely 2-celled, several-seeded, sulcate at both sutures, acute to acuminate, at length incurved, ascending, glabrous.

Specimens of this species were collected in Sutton, Schleicher, Crockett, Irion, Reagan, and Upton counties, the total number of sheets being 152. The TYPE specimen, No. 134, was collected May 5, 1929 from a northern tributary of Bates Draw at a point six miles north of Big Lake in Reagan County, Texas. It is deposited in the herbarium of the Texas Agricultural Experiment Station at College Station, Texas. Authentic material has been deposited in the Gray Herbarium.

This species is related to *A. mollissimus* Torr., with which it agrees in having glabrous fruit but differs in having yellowish-white flowers and the calyx teeth nearly equaling the tube. While these differences are quite distinctive neither species occurs within the range of the other one and, moreover, one grows in sandy soils and the other grows in clayey soils.

DISCUSSION

The new species grows in clayey soils in grass-land along draws and in depressions or lake-beds on the divides, but not in weedy valleys or weedy lake-beds; and it is limited in distribution to the northwestern part of that portion of the Edwards Plateau lying east of the Pecos River. It occurs as far south as 2½ miles below the north line of Sutton County near its northwestern corner, as far east as 3 miles south of Mertzon in Irion County, as far north as the north line of Reagan County, and as far west as 6 miles southwest of Rankin and 6 miles northwest of Upland in Upton County.

Outside of the territory thus outlined a collection of this loco was received from an isolated station about fifteen miles southeast of Sterling City. While this collection was from along the North Concho River the writer was unable to find any loco along this stream or its tributaries in Sterling County. From this station to the south and southwest it is thirty miles or more to the nearest occurrence of loco on the tributaries of the Middle Concho River. This collection was received in the mail after the writer had visited the North Concho River drainage area and had come to the conclusion that the same was free from loco, or otherwise a more inclusive inspection would have been made. As it was, that portion of this area lying northwest of Sterling City was not visited at all. From this circumstance it seems possible that other scattering outposts of this loco may be located in the North Concho River drainage area.

Other species of loco grow both to the west and to the north of this one, but apparently intervening is a wide belt wherein no loco grows. *Astragalus argillophilus* does not extend to the Pecos River, its nearest approach to the same being about twelve miles from it on Five Mile Creek in Upton County; and it has not been reported from the western side of that river, nor does it reach the boundary of the Edwards Plateau and the High Plains. A detailed study of the southern limit of *Astragalus mollissimus*, the loco plant extending furthest south on the High Plains, has not been made, but that species has not been found on the Edwards Plateau.

The species described herewith is definitely known as a loco plant by reason of authenticated instances of horses, cattle, and goats becoming locoed through feeding upon it. It has at no time caused any extensive losses, and those occurring have been confined largely to horses and steers in seasons of short range.

In certain localities much determined effort has been made toward the eradication of this species, but its complete extermination will be long delayed if, indeed, it ever takes place.

Texas Agricultural Experiment Station.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY—NO. LXXXVII

I. LIGUSTICUM SCOTHICUM OF THE NORTH ATLANTIC AND OF THE NORTH PACIFIC

M. L. Fernald

(Plates 193 and 194)

The Scotch Lovage, *Ligusticum scothicum* L., is generally treated as having two widely separated areas of distribution, one on the North Atlantic: the coasts of Scandinavia, the British Isles and Iceland at the east and of southern Greenland, Labrador, eastern Canada, New England and southeastern New York at the west; the other on the North Pacific: southern Alaska and Kamtchatka to Japan. The two areas are, obviously, quite isolated; and, whenever I have had for identification material from the North Pacific, I have at first failed to recognize it as *Ligusticum scothicum*, for in its small and compact convex-topped flowering umbels it has always seemed very different from the plant I have intimately known for forty years on the shores from Long Island to Labrador, the latter plant having the primary umbels much broader and flat-topped. From time to time I have undertaken a closer comparison of the plants of these two remote areas but, owing to lack of mature fruit of the plant of the North Pacific, have as regularly abandoned the study. Recently, however, realizing that the great student of the Kamtchatkan flora, Dr. Eric Hultén of the Riksmuseum at Stockholm, must have before him abundant material of both plants, I referred the question to him. My attempt thus to delegate the problem, however, proved a "boomerang"; Dr. Hultén responded by supplying me with excellent fruiting material from Kamtchatka and from Japan, thus encouraging me to look further into the question. The result of this renewed study is the proposal of

Ligusticum **Hultenii**, n. sp. (t.), *L. scothicum* simulans; foliolis

foliorum inferiorum subrotundatis vel late rhomboideis 1–7 cm. longis crenato-dentatis, venulis plerumque confluentibus areolas clausas formantibus; umbellis hemisphaericis ad anthesin convexis primariis 3–5.5(–7) cm. latis; fructu anguste oblongo 8–10 mm. longo 2–2.5 mm. lato.—Alaska and Kamtchatka to Japan. Alaska: Fort St. Michael, Norton Sound, 1865–66, *H. M. Bannister;* False Pass, Alaska Peninsula, August 3, 1925, *O. J. Murie,* no. 67; Lake Iliamna region, 1902, *Gorman,* no. 114; Ocean Cape, Yakutat Bay, July 18, 1892, *Funston,* no. 70; grassy edge of woods, Prince of Wales Island, August 8, 1915, *Walker,* no. 916a; Sitka, *Mertens;* shore, Sitka, August 8, 1907, *Cowles,* no. 1089; Ilinlink, Unalaska, September, 1871, *M. W. Harrington;* Unalaska, July 25, 1891, *J. M. Macoun;* on moisture-bathed rock or in moist lowlands along streams, Unalaska, July 6, 1907, *Van Dyke,* no. 7; moist places, Makushin Bay, Unalaska, July 14, 1907, *Van Dyke,* no. 169; Amchitka Island, July 25, 1873, *Dall;* Nazan Bay, Atka, July 26, 1907, *Van Dyke,* no. 238 (type in Gray Herb.); Akutan, August 21, 1907, *Van Dyke,* no. 325. Kamtchatka: Petropavlovsk, 1853–56, *C. Wright,* August 17, 1920, Hultén, no. 932. Japan: Kokodate, 1859, *Wilford,* 1861, *Maximowicz,* July 10, 1890, *Miyabe & Tokubuchi;* Sapporo, July 7, 1903, *Arimoto.*

Named for Dr. Eric Hultén, whose critical studies of the flora of Kamtchatka are clearing the identities of plants of many other sections of the northern hemisphere.

Superficially, *Ligusticum Hultenii* is at once separated from well-developed *L. scothicum* by the smaller and more rounded crenate-dentate leaflets of the lower leaves and the very small and convex umbels. The lower leaves of *L. scothicum* of shores of the North Atlantic have the leaflets usually narrower, more cuneate at base, more cleft and commonly acute to acuminate and more serrate-dentate (though in small northern forms they may be crenate), and the lower leaflets are often 1 (sometimes even 1.5) dm. long; and the primary umbels of *L. scothicum* are broader, in anthesis 4–10 cm. broad and essentially flat on top. The fruit of *E. Hultenii* is slightly but appreciably narrower, the mature merocarps 2–2.5 mm. wide, while in *L. scothicum* they are 2.5–4 mm. broad. Probably the most positive difference in the foliage is found in the venation of the leaflets of the lower leaves: in *L. scothicum* (Plate —) the larger veinlets are confluent, thus forming areolae, but a large proportion of the ultimate ones have free ends; in *L. Hultenii* (Plate —) most of the veinlets of the lower leaves are confluent, forming areolae. This difference is clearly brought out in the micro-photographs kindly prepared by Mr. Albert N. Steward.

Photo. by A. N. Steward.

VENATION OF BASAL LEAFLET OF LIGUSTICUM SCOTHICUM
(UPPER FIG. × 3, LOWER FIG. × 20)

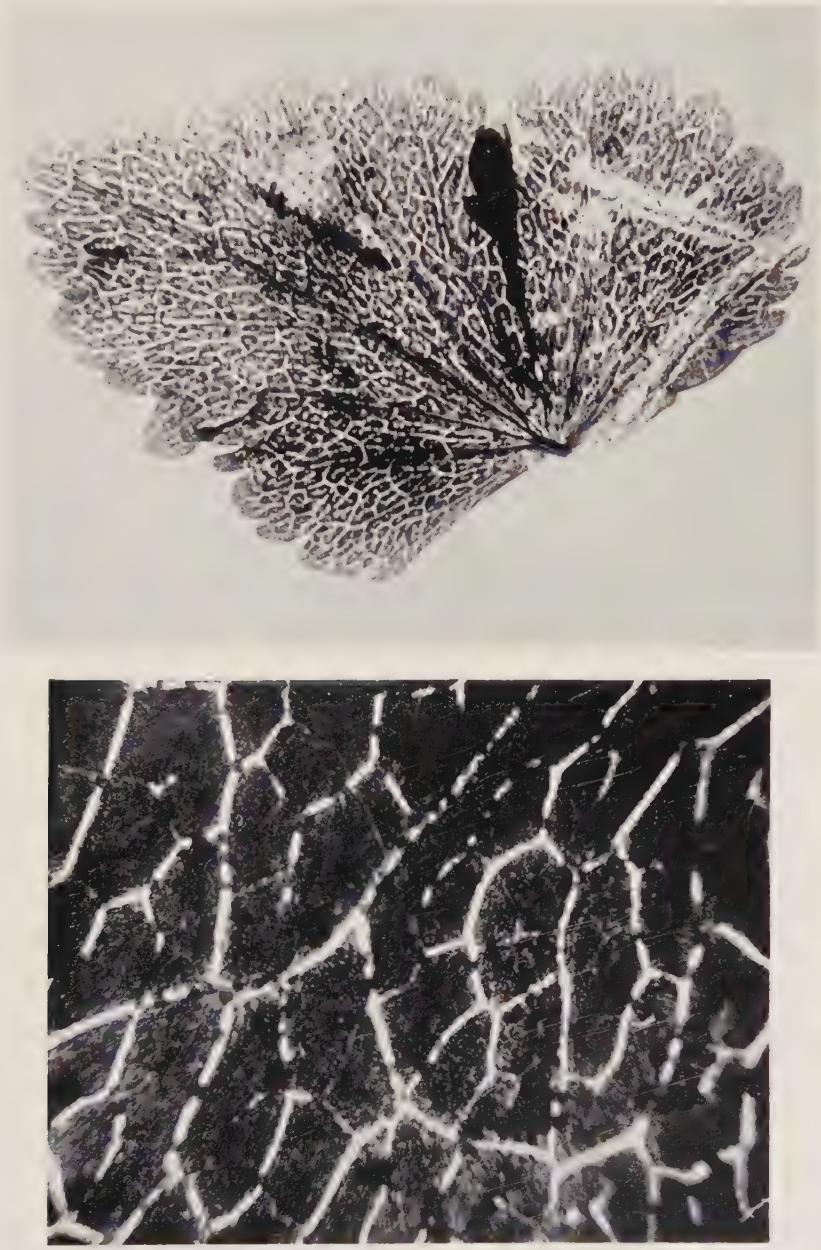

Photo. by A. N. Steward.

VENATION OF BASAL LEAFLET OF LIGUSTICUM HULTENII
(UPPER FIG. × 3, LOWER FIG. × 20)

Explanation of Plates 193 and 194

Plate 193, upper fig., basal leaflet of Ligusticum scothicum, to show venation, × 3; lower fig., venation × 20. Plate 194, upper fig., basal leaflet of L. Hultenii, to show venation, × 3; lower fig., venation, × 20.

II. CAREX MACROCEPHALA AND C. ANTHERICOIDES

M. L. Fernald

Dr. Charles W. Townsend sent me in November last a much battered "pocket specimen" of a grass-like plant which he had found "on a sand dune near Seaside Park, near Tom's River, New Jersey," with the additional information that "it was said to have spread rapidly over the dune, and that it was never planted there . . . The care-taker of the property thought it would be an excellent sand binder, which it appears to be, as it makes a close mat." The plant had nearly cylindric culms and no fruit, so, taking it upon casual inspection to be a grass, I sent half the material to Mrs. Agnes Chase for identification. In the absence of Mrs. Chase, the plant was examined by Mr. E. C. Leonard who has correctly identified it as *Carex macrocephala* Willd. of the sandy coast of eastern Asia, from eastern Kamtchatka, Sachalin Island and Japan to Shantung. It is apparently quite at home on the New Jersey sands, for Mr. J. R. Swallen of the Bureau of Plant Industry writes: "This is the second specimen that has been sent in from New Jersey."

Carex macrocephala is generally supposed to occur on the Pacific coast of North America, from southern Alaska to Oregon; but Dr. Townsend's material so closely matches the Asiatic specimens and so far departs from the fine series in the Gray Herbarium from the sands of British Columbia, Washington and Oregon that I have compared the two series with some care. It now becomes clear that the plant of western North America is a thoroughly distinct species, for more than a century wrongly identified with the Asiatic *C. macrocephala*. The American species is C. anthericoides Presl., Rel. Haenk. 204 (1828), originally collected at Nootka Sound on Vancouver Island; and it is distinguished from the Asiatic by characters of the rootstock, lowest leaves, rosette-leaves, culm, scales, anthers and achenes. The original description by Willdenow of the Asiatic plant was meagre, but the very complete description of true *C. macrocephala* given by Regel[1] and beautifully illustrated by him may be compared

[1] Regel, Tent. Fl. Ussur. 164, t. xii. figs. 8–12 (1861).

with the equally full original description by Presl of his *C. anthericoides* or the beautiful plate (as *C. macrocephala*) of Francis Boott.[1] The Regel and Presl descriptions and the Regel and Boott plates accurately portray the two species, while Kükenthal's description[2] was based primarily upon Asiatic material and Mackenzie's description and accurate figure of the American plant in Abrams's Illustrated Flora[3] are drawn from American specimens.

The rootstock of *C. macrocephala* soon loses the shredded sheaths, that of *C. anthericoides* retains them tightly investing the internodes. In *C. macrocephala* the leafy shoots have few if any bladeless basal leaves, and the bases of the true foliage-leaves quickly disintegrate into fibres ("Culmi . . . basi fibris foliorum emarcidorum vestiti"—*Regel*); in *C. anthericoides* the basal leaves are reduced, dry and bladeless and they, as well as the long green leaves above them, rarely if ever disintegrate into fibres. In *C. macrocephala* the upper leaf-surface is scarcely ribbed, in *C. anthericoides* prominently so; in *C. macrocephala* the fresh leaf-margins are coarsely (often papillately) toothed ("Folia . . . marginibus grosse serrata"—*Kükenthal*), in *C. anthericoides* the serration is much finer and spinulose ("margins minutely but sharply serrulate"—*Mackenzie*). The culm of *C. macrocephala* is very obtusely angled, almost cylindric, and smooth ("Culmi . . . obtuse triangulares, leaves, glabri"—*Regel;* "Culmus . . . obtusangulus laevis"—*Kükenthal*); the culm of *C. anthericoides* harshly serrate on the sharp angles ("Culmus . . . triqueter striatus angulis serrato-scaber"—*Presl;* "*Culmus* . . . triqueter, scaber"—*Boott;* "Culms . . . often strongly roughened on the angles"—*Mackenzie*). In *C. macrocephala* the scales of the spikes are herbaceous and greenish, with pale firm borders, becoming drab, and they are conspicuously toothed on the margin ("Squamae . . . praecipue apicem versus serrulatae, herbaceae,"—*Regel;* "Squamae . . . in acumen . . . marginibus eroso-denticulatum attenuatae"—*Kükenthal*); in *C. anthericoides* the scales have thin, scarious or hyaline brown sides and, except for the outer bracteal ones, are quite entire ("Glumae . . . dorso nervoso-striatae virescentes, margine fuscae"—*Presl;* "squama . . . ferruginea"—*Boott;* "scales . . . brownish with green center and hyaline margins"—*Mackenzie*), the margins beautifully

[1] Boott, Ill. Carex, i. 27, t. lxix (1858).
[2] Kükenthal in Engler, Pflanzenr. iv[20]. 187 (1909).
[3] Mackenzie in Abrams, Ill. Fl. i. 293, fig. 691 (1923).

shown in the illustrations cited, Regel's fig. 12 of the Asiatic plant showing the characteristically toothed scale, Boott's figs. *c*, *g* and *h* and Mackenzie's figure of the American correctly representing entire scales. The anthers of the Asiatic *C. macrocephala*, as shown by 4 staminate inflorescences before me, are 4.5–6 mm. long; in the American *C. anthericoides*, as shown by Boott's illustration and by several sheets of specimens, only 2–3.3 mm. long. The achene of the Asiatic *C. macrocephala* tapers to the base, that of the American is strongly rounded at both ends, as clearly shown in Boott's figs. *ff*.

Altogether, the specific distinctness of the plants of the two sides of the North Pacific is apparent. Geographically they parallel numerous other cases and it is at least worth noting that true *Carex macrocephala*, now establishing itself on the Atlantic coast of North America comes from the same region as the other sea-shore species, *Artemisia Stelleriana* Besser, which has rapidly fixed itself upon our coastal dunes and beaches. It is also not without interest that the coarse Sand Reed or Psamma of Atlantic America, *Ammophila breviligulata* Fernald[1] should have proved to be specifically quite unlike the European *A. arenaria* (L.) Link; but that the European, rather than the Atlantic American, plant should have made itself at home on the Pacific coast of North America.

(*To be continued.*)

Dynamic Forces in the Flora of Quebec.[2]—In this interesting address, delivered by Frère Marie-Victorin, as retiring president of the Société Canadienne d'Histoire Naturelle, we have the Quebec Flora viewed as something dynamic, mobile, feeling the surge of life, and the constant impulse to change. The apparent stability of the flora during a period of years, or even a century, cannot hide the fact that all is changing. "Plant associations are living mosaics where slowly, parallel to the physical evolution of the ecologic factors, and often outside of it, substitutions take place. The equilibrium which impresses us by its apparent stability is only an equilibrium of the whole, and not the equilibrium of the parts; it is only a resultant, a product which remains apparently the same during very long periods at least, but the factors of which are subject to perpetual changes of order and importance."

The influences which affect the flora of a region may be classified more or less arbitrarily as intrinsic, those which arise from the possibilities inherent in the plant life itself, and extrinsic, those which arise from

[1] Fernald, Rhodora, xxii. 71 (1920).

[2] *Le Dynamisme dans la Flore du Québec*, par Frère Marie-Victorin. 89 pages, 42 figures, 1929. $1.00. Contributions du Laboratoire de Botanique de L'Université de Montréal, No. 13.

modifications in the external or ecologic conditions under which the plants live.

The forces of evolution have first claim as intrinsic factors. The emphasis in evolutionary studies has been on lines of descent; here it is necessary to take a broader view of the subject, to consider the development of the whole flora. "The view which the flora of our country offers us, and the lessons which may be drawn by studying it attentively, can only strengthen this conviction that vegetable life continues a development begun long since, that it brings forth still more or less rapidly new specific or varietal entities, and that the possibilities of development are by no means exhausted by the actual development of the species and the normal development of the individual."

As examples of *discontinuous* evolution, Brother Victorin cites two species of *Senecio* which show veritable mutations, *S. pauperculus* with its forma *verecundus* Fernald and *S Pseudo-Arnica* and its variation which is here elevated to specific rank as *S. Rollandii*. Both of these are found in abundance, for Brother Victorin usually has "des milliers" of plants before he is willing to venture a new description.

As the next instance of *discontinuous* evolution he cites the involved group *Crataegus*, fifty species of which, several endemic, are known from Quebec. "For the thorns are not forest species; their expansion demands dry places and abundant light. In prehistoric times all Quebec was covered with thick forests, and open places other than marshes and peat-bogs were decidedly rare. The thorns could only establish themselves with difficulty in little isolated groups along the watercourses. It is thus that we see them today at the limits of their distribution, at their vanguard, on the shores of Lake St. John, at Temiscaming and at Anticosti. It seems then that the great development of the genus in America is the immediate result of the break in ecologic equilibrium caused by deforestation. Not that the new environment thus created at once formed new entities in molding them to its conditions. That is an *a priori* concept that everything today forces us to abandon. It seems indeed rather that the species, because of a dynamic force which we still fail to understand, and under the stimulus of environment, produced by chance, in all directions, mutations which have in themselves no connection with either environment or utility."

An excellent map shows the different routes by which the species of *Crataegus* entered Quebec, and distributed themselves in the Province.

Evolution, apparently *continuous*, has produced many floral changes. Conspicuous among these is the differentiation between the gymnosperms of the Cordilleran region and those of eastern America, brought about at the end of the Cretaceous period, when an inland sea occupied the central part of our continent, and continued later by the wide belt of prairies which in the Tertiary took the place of the sea. Accordingly the western pines, fir and larch are parallel to our eastern species, but not identical with them.

Another change was brought about during early Tertiary (période nummulithique) when the North Atlantic land bridge between America and Europe gradually disappeared. Species which we now think of as distinctly American, like *Liriodendron tulipifera, Fraxinus americana, Tsuga canadensis, Sassafras officinale*, and even *Brasenia Schreberi* and *Dulichium arundinaceum*, had flourished in Europe during the early

Tertiary, but now became extinct there. Other plants which persisted gradually became different from their parallel species in America, till *Juniperus communis* is perhaps the only tree left which is approximately the same on both continents. "But the present flora of the Gulf of St. Lawrence contains a small but rather important little flora, the Alpine, Scandinavian or Baltic affinities of which are most startling. Certain elements like *Scirpus alpinus*, *Carex salina*, var. *kattegatensis*, *Polygonum acadiense*, *Carex vesicaria*, var. *Grahami*, have remained unchanged, while others like *Carex Hostiana*, var. *laurentiana*, of Newfoundland and Anticosti, have diverged more or less from the primitive type."

There followed the glacial period with its violent changes, and the milder interglacial epochs. In Quebec the *Ginkgo biloba* became extinct, and also several maples, among them *Acer pleistocenium*, closely parallel with *Acer platanoides* of Europe. During the last interglacial epoch the northern part of our continent seems to have been covered with a flora closely related to the Cordilleran flora of today. Scattered mountain peaks in the Shickshocks of Gaspé and other limited areas in Quebec, as well as much of the mountainous part of western Newfoundland escaped the general glaciation, either as nunataks rising above the level of the ice-sheet, or as lobal areas between diverging branches of the glacier. Numerous Cordilleran species survived in these places, and with the departure of the ice-sheet these spots became centers of endemism. The explorations of Fernald and his associates, as well as those of Brother Victorin and his Quebec botanical friends have made these known to science. Among the endemics which remained near their place of origin may be cited *Myriophyllum magdalenense* of the Magdalen Islands, *Antennaria eucosma* of Newfoundland, *Arnica Griscomi* of the Shickshocks, and *Draba pycnosperma* of Percé.

Other species have left the places where they survived, and spread. Among these may be mentioned *Botrychium minganense*, *Gentiana nesophila* and *Orobanche terrae-novae*. *Streptopus oreopolus* is of special interest, as it has been found on the White Mts., and recently by G. L. Stebbins, on Mt. Katahdin.

Another group of plants which show the dynamic forces still active in the Quebec flora are the estuarine plants investigated by Fassett,[1] especially *Bidens hyperborea* and its numerous variants.

So far the essay has dealt with constructive forces in the flora. "It seems also probable that under the continual influence of external conditions, certain species can retrograde and disappear through degeneration, although the facts are less easy to verify." Several types of the epibiotic Cordilleran group show a very clear retrogressive tendency. In this way may be explained, in reference to their type such variations as *Erigeron lonchophyllus*, var. *laurentiana*, *Draba luteola*, var. *minganensis*, and *Cypripedium passerinum*, var. *minganense*, recent discoveries of Brother Victorin in his summer explorations,[2] as well as other isolated species. "A law of death seems to weight down this Cordilleran group of plants, a law which reduces it to burying itself in protected ravines to escape the final destruction which awaits it. Which is the real cause here, intrinsic insufficiency or external pressure?"

[1] Fassett, N. C., *Bidens hyperborea* and its varieties. Rhodora xxvii, 166–171, 1925.

[2] *Deux Epibiotes remarquables de la Minganie*, par Frère Marie-Victorin. Contributions du Laboratoire de Botanique de l'Université de Montréal. No. 12, 1928.

The intrinsic forces of evolution modify the flora profoundly in time, by modifying the elements of which it is composed. The extrinsic factors work much more quickly, not on the individual plant, but on the expansion of species and their grouping in time and place. Changes of climate and physiographic conditions are of first importance. Thus the mild climate which surrounded the Champlain sea even before all the glaciers had completely melted, may explain the northern extensions of such plants as *Lycopodium tristachyum* and *Solidago puberula* and the genus *Crataegus*.

There is some reason to think that the continental side of the strait of Belle Isle may once have been wooded heavily, though there are different explanations for the presence of large stumps at Blanc Sablon. At any rate there are found in this region, mixed with a strictly boreal flora, such plants as *Botrychium virginianum*, *Milium effusum*, *Carex Deweyana*, *Streptopus amplexifolius*, *Viola Selkirkii* and *Solidago macrophylla*, a group which only needs the spruce forest to be perfectly at home several degrees further south in the St. Lawrence valley, or in the Green Mts. of Vermont. In like manner there is some question as to whether the spruce forest which covers the north shore of Anticosti is not a case of the survival of the *existent*. There is much doubt whether under present climatic conditions such a forest could reëstablish itself in that locality again. Local chilling of the sort which may be indicated here and at Blanc Sablon is, however, probably due to changing currents or something of the sort, and is an episode of no general importance, compared with the great climatic changes known to have occurred in the earth's history.

Human life has also had a tremendous extrinsic influence on our flora, for when man had once begun to domesticate plants, he had to wrest the soil from other species to make room for them. "When the shelter of the cave and the skin tent ceased to be sufficient for him, man with his stone axe attacked the tree, and opened the forest. Then began the deforestation of the planet, the contest of a spiritual factor against the agelong forces of nature. A most violent action of itself, deforestation released a whole series of dynamic reactions among the floras of the world." Important among these is the beneficent change of climate, which has already abated the rigors of such new sections as Abitibi and the region of Lake St. John.

Fire also broke loose as an agent for clearing the land. When left to itself the burnt land by a series of plant successions gradually tends back toward primitive conditions. But where the land is permanently cleared, European plants, mostly annuals, which have crossed the Atlantic with man, become quickly acclimated, "sometimes (as around the city of Quebec) nearly displacing the indigenous plants, and becoming veritable scourges." Other waifs have followed the railways and other routes of travel, some, an increasing number, coming from the west, and at least one, *Galinsoga*, from tropical America.

There have indeed been many changes since the old-time botanists first visited Quebec. "What would the spring be without the resplendent flowering of the dandelions; what would our summer fields be without the starry daisies, the caerulean touch of the chicory, and without the blood-tinged vividness of the orange hawkweed? And how different now are the shores of the St. Lawrence between Montreal and Three Rivers, with the rich mantle which the purple loosestrife gives to the

low islands, and the *Butomus* to the river flats!" This latter is a newcomer which in less than forty years has taken possession. "It is a fine example of the overturn which can be brought about in a flora by a single species, when it is well equipped and leaves its horde of enemies behind as it enters a new territory—a fine illustration of dynamic violence in time and space."

"From this rapid survey, some conclusions stand out, it seems, rather clearly.

"The intrinsic influences, forces of evolution or elimination which have dynamic influence on floras in general, and on the flora of Quebec in particular, are a function of the nature of organic beings, and will continue to work out slowly but relentlessly in the direction of development, or in the direction of retrogression.

"The extrinsic influences, which have to do especially with the intelligent activity of man, and his means of action on nature, are essentially more rapid and brutal. They tend to blend and blur the floras, to lead them to a state of equilibrium quite different from the natural equilibrium. By destroying barriers, by suppressing distances, by setting in motion agents of transportation which upset the agelong balance of the elements of the biosphere, they tend to establish on the planet a certain uniformity which would be a state of equilibrium analogous to that toward which the forces of erosion tend. But these extrinsic forces would gradually lose their intensity in case of the destruction of our civilization and a return to barbarism; they would cease to act with the disappearance of the human race. The old balance ought then to reëstablish itself, in considerable measure. The hordes of plants long held in check by human toil, the plants of prey long treated as enemies, would advance over our fields, would rise to the assault of our cities and towns, would cover the ruins of them with thick masses of vegetation, while above the ashes of the human edifice, in an atmosphere become more pure, above an earth once more silent, would shine again, liberated, wild, yet magnificent, the torch of life."—Clarence H. Knowlton, Hingham, Massachusetts.

A Callitriche new to Massachusetts.—*Callitriche deflexa* A. Br., var. *Austini* (Engelm.) Hegelm. is one of the most obscure flowering plants. Prostrate upon the ground, little branched, with leaves "2–4 mm. long," it looks like nothing at all, or at most like sterile basal shoots which may later grow to be something. This probably accounts for its having been so long overlooked on one of the most frequented trails on Mt. Toby. Here it was first collected by the writer on 27 July 1927. It was seen again in 1928, but not collected again until 10 July 1929, as its rarity was not at first suspected. The identification has been kindly verified by Mr. C. A. Weatherby of the Gray Herbarium, who states that it appears to be the first collection of this species in Massachusetts. The Manual records its range as far north as Connecticut, only. This station is

in the town of Sunderland, Franklin County. There is a considerable quantity of the plant scattered along quite a long strip of old lumber road through the woods.—FRANK C. SEYMOUR, North Amherst, Mass.

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